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Sensor for Detecting Fog-Like Media

Description

The invention concerns a sensor for detecting fog-like media. Fog-like media are e.g. fog, mist, vapor, smoke or the like. The invention also concerns a method for detecting such fog-like media.

Sensors and methods of this type may be used, in particular in automotive technology, to increase the safety standard of vehicles. The sensors and methods may be used e.g. for automatic switching on and off or control of fog lights of a vehicle, for issuing a warning to the driver or for automatic speed adjustment in dependence on the weather conditions.

The detection of fog-like media is problematic, since these media are generally translucent.

It is therefore the underlying purpose of the present invention to provide a sensor which is suited for detecting fog-like media and also a method for detecting fog-like media.

This object is achieved with a sensor comprising at least two transmitters and at least one receiver, wherein the transmitter axes and the receiver axis intersect at two different positions, and with an evaluation unit which detects the medium when the receiver detects signals transmitted by both transmitters.

This object is also achieved by a sensor comprising at least one transmitter and at least two receivers, wherein the transmitter axis and the receiver axes intersect at two different positions, and with an evaluation unit which detects the medium when the two sensors receive signals transmitted by the transmitter.

The inventive sensor checks, at at least two different positions, whether transmitted signals are reflected by the fog-like medium and therefore whether or not fog-like media are present. The presence of such fog-like media produces spatial reflection. If no media are present, no reflection occurs. If there is a massive object which cannot be spatially penetrated by light, there is generally no reflection at the detected positions. The surface of an object which cannot be penetrated by light is neither at the one nor at the other position. The transmitted signals may be reflected at either one or the other position, if at all, depending on the position of the object. However, reflection at both positions is impossible.

The inventive sensors are therefore suited to detect fog-like media in a simple manner.

The inventive sensors preferably comprise an optics which focuses the signals to be transmitted or received along a respective, preferably largely cylindrical or linear beam and along the respective transmitter or receiver axis. This is advantageous in that the positions at which the axes intersect subtend a relatively small volume thereby providing a relatively precise measurement.

In one advantageous embodiment, the two transmitter axes or the two receiver axes extend largely parallel to each other. The two receiver axes or the two transmitter axes should not intersect each other.

An advantageous sensor is characterized in that the evaluation unit is suited to determine the density of the medium to be detected on the basis of a comparison of the intensity of the signals to be transmitted and of the intensity of the signals to be received. The properties of the medium can be detected by comparing the intensities of the transmitted and received signals. In case of dense fog, the intensity of the receiving signals is different from that of less dense fog.

An advantageous sensor can be obtained if the transmitter is an infrared transmitter and the receiver is an infrared receiver.

In particular, if the sensor is used for a vehicle, it is advantageous that the sensor be suitable for mounting to a window, in particular to the windshield of a vehicle.

To optimally reduce the signal loss, a coupling means may be provided between the optics and the window. To obtain a compact sensor, the at least one transmitter and/or the at least one receiver may be disposed on a circuit board. It may also be advantageous to dispose the evaluation unit on this circuit board.

The inventive sensor preferably generates a signal for controlling a system to detect fog. Such a system may e.g. be the fog lights of a vehicle, i.e. the fog lights are automatically activated upon detection of fog-like media or are deactivated if fog-like media are no longer detected. Moreover, a warning signal may be issued to the driver in the form of an optical, acoustic or tactile signal, to draw his/her attention to the accumulating fog.

The above-mentioned object is also achieved by a method for detecting fog-like media which is characterized in that signals are transmitted by at

least two transmitters, wherein a receiver axis of a receiver intersects the two transmitter axes at different positions and subsequently detects the medium when the receiver receives the signals transmitted by both transmitters.

The above-mentioned object is also achieved by a method which is characterized in that signals are transmitted by at least one transmitter, wherein at least two receiver axes, each associated with one receiver, intersect the transmitter axis at different positions and the medium is subsequently detected when the receivers receive signals transmitted by the transmitter.

The density of the medium can advantageously be determined by comparing the intensity of the transmitted signals and of the intensity of the received signals.

The method is advantageous when the transmitter or the transmitters transmit(s) signals with a time delay and/or alternately. This permits association of the transmitted signals with the received signals.

The inventive method advantageously also concerns infrared signals.

The method transmits a signal when the medium is detected which permits control of e.g. the fog lights of a vehicle or a warning signal.

Further advantageous details and embodiments of the invention can be extracted from the following description which further describes and explains the invention on the basis of the embodiments shown in the drawing.

Fig. 1 shows a schematic view of a first inventive sensor; and

Fig. 2 shows a schematic view of a second inventive sensor.

Fig. 1 shows a sensor 10 for detecting fog which is disposed, with a housing 12, on the inner side of a vehicle window 14. The sensor 10 comprises a board 16 on which two transmitters 18, 20 and one receiver 22 are disposed. On the side facing the window 14, the sensor 10 comprises an optics 24 and a coupling layer 26 disposed between the optics 24 and the window 14.

The optics 24 is designed to focus the infrared signals transmitted by the transmitters 18, 20 along a preferably largely linear beam 28, 30. In the sensor 10 shown in the figure, the axes directions of the beams 28, 30 are largely identical.

The optics 24 moreover directs the signals to be received by the receiver 22 to substantially lie along a straight beam 32.

The two beam paths 28, 30 are parallel (Fig. 1). The beam path 32 intersects the two beam paths 28, 30 at two different positions P_1 and P_2. All beam paths 28, 30, 32 are therefore co-planar.

The sensor 10 also includes an evaluation unit 32 which detects fog when the receiver 22 receives signals transmitted by both transmitters 18, 20, which are reflected by fog particles 36, 38 at positions P_1 and P_2. Due to the presence of fog particles in space, the reflection does not occur at a defined border layer, but is distributed in space, along the transmitter axes 28, 30, i.a. also at positions P_1 and P_2.

If a body which cannot be spatially penetrated by light (indicated in Fig. 1 by reference numeral 34) is located in the region of the sensor 10, this

body 34 is reflected at points P_3 and P_4. Since the points P_3 and P_4 are not on the receiver axis 32, the receiver 22 receives no signals. Only if fog-like media are present in the detection range of the sensor 10, are the signals transmitted by the transmitters 18, 20 detected by the receiver 22.

The signals transmitted by the transmitters 18, 20 are preferably transmitted with a time delay or alternately which provides information concerning whether the signals received by the receiver 22 have come from the transmitter 18 or transmitter 20.

Of course, in accordance with the invention, more than two transmitters and more than one receiver may be provided in a sensor. Provision of several different positions of intersecting beam paths permits safe and accurate statements about the presence of fog in the detected range.

The sensor 10 is preferably coupled to other vehicle systems via communication means 34. It may e.g. be provided that the fog lights of the vehicle are activated when the fog sensor 10 detects fog. It is also feasible to emit warning signals to the driver in case of fog.

The sensor 50 shown in Fig. 2 differs from the sensor 10 of Fig. 1 in that signals transmitted by a transmitter 52 along a transmitter axis 54 intersect two receiver axes 56, 58 of two receivers 60, 62 at two different positions P_{10}, P_{20}. Infrared signals transmitted by the transmitter 52 are detected by the two receivers 60, 62 only when fog-like media are present in the detection range of the sensor 50.

The intensity of the transmitted signals can advantageously be compared with the intensity of the received signals using the evaluation unit 31 to provide information about the density of the detected fog-like medium.

All of the features shown in the description, the following claims and the drawing may be essential to the invention either individually and also collectively in arbitrary combination.